

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

**AMENDMENTS TO THE CLAIMS**

1-33 (Cancelled)

34. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:  
obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;  
electronically evaluating said image to obtain information about volume; and  
selecting a therapy based on said information.

35. (Withdrawn) The method of claim 34, wherein said electronically evaluating further comprises:  
estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,  
obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,  
obtaining a three-dimensional map of the cartilage at a later time,  
calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and  
determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

36. (Withdrawn) The method of claim 34, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

37. (Withdrawn) The method of claim 34, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,  
determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,  
obtaining the thickness of the cartilage defect,  $D_D$ , of the region,  
subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and  
multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

38. (Withdrawn) The method of claim 34, wherein said electronically evaluating further comprises:

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

39. (Withdrawn) The method of claim 34, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

40. (Withdrawn) The method of claim 34, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,  
defining a 3D object coordinate system of the joint at an initial time, T<sub>1</sub>, identifying a region of a cartilage defect within the 3D object coordinate system, defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint, T<sub>2</sub>, placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

41. (Withdrawn) The method of claim 34, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,  
(a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,  
(b) obtaining the bone image data of the joint with a set of skin reference

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

markers positioned in the same manner as the markers in (a),

(c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and  
(d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

42. (Withdrawn) The method of claim 34, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

43. (Withdrawn) The method of claim 34, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

44. (Withdrawn) The method of claim 34, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

45. (Withdrawn) The method of claim 34, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

46. (Withdrawn) The method of claim 34, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

47. (Withdrawn) The method of claim 46, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

48. (Withdrawn) The method of claim 47, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

49. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:

obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;

electronically evaluating said image to obtain information about area; and  
selecting a therapy based on said information.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

50. (Withdrawn) The method of claim 49, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,  
obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,  
obtaining a three-dimensional map of the cartilage at a later time,  
calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and  
determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

51. (Withdrawn) The method of claim 49, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

52. (Withdrawn) The method of claim 49, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,

determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,

obtaining the thickness of the cartilage defect,  $D_D$ , of the region,

subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and

multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

53. (Withdrawn) The method of claim 49, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

54. (Withdrawn) The method of claim 49, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,  
measuring a detectable biochemical component throughout the cartilage,  
determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

55. (Withdrawn) The method of claim 49, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time, T<sub>1</sub>,  
identifying a region of a cartilage defect within the 3D object coordinate system,  
defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint, T<sub>2</sub>,

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

56. (Withdrawn) The method of claim 49, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

- (a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,
- (b) obtaining the bone image data of the joint with a set of skin reference markers positioned in the same manner as the markers in (a),
- (c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and
- (d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

57. (Withdrawn) The method of claim 49, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

58. (Withdrawn) The method of claim 49, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

59. (Withdrawn) The method of claim 49, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

60. (Withdrawn) The method of claim 49, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

61. (Withdrawn) The method of claim 49, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

62. (Withdrawn) The method of claim 61, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

63. (Withdrawn) The method of claim 62, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

64. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:

obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;

electronically evaluating said image to obtain information about thickness; and selecting a therapy based on said information.

65. (Withdrawn) The method of claim 64, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,

obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,

obtaining a three-dimensional map of the cartilage at a later time, calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

66. (Withdrawn) The method of claim 64, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

67. (Withdrawn) The method of claim 64, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,  
determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,  
obtaining the thickness of the cartilage defect,  $D_D$ , of the region,  
subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and  
multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

68. (Withdrawn) The method of claim 64, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

69. (Withdrawn) The method of claim 64, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

70. (Withdrawn) The method of claim 64, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time, T<sub>1</sub>,  
identifying a region of a cartilage defect within the 3D object coordinate system,  
defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint, T<sub>2</sub>,  
placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and  
measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

71. (Withdrawn) The method of claim 64, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

(a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

(b) obtaining the bone image data of the joint with a set of skin reference

markers positioned in the same manner as the markers in (a),

(c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and

(d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

72. (Withdrawn) The method of claim 64, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

73. (Withdrawn) The method of claim 64, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

74. (Withdrawn) The method of claim 64, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

75. (Withdrawn) The method of claim 64, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

76. (Withdrawn) The method of claim 64, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

77. (Withdrawn) The method of claim 76, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

78. (Withdrawn) The method of claim 77, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

79. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:

obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;

electronically evaluating said image to obtain information about curvature; and selecting a therapy based on said information.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

80. (Withdrawn) The method of claim 79, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,  
obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,  
obtaining a three-dimensional map of the cartilage at a later time,  
calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and  
determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

81. (Withdrawn) The method of claim 79, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

82. (Withdrawn) The method of claim 79, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,

determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,

obtaining the thickness of the cartilage defect,  $D_D$ , of the region,

subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and

multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

83. (Withdrawn) The method of claim 79, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

84. (Withdrawn) The method of claim 79, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

85. (Withdrawn) The method of claim 79, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time,  $T_1$ ,

identifying a region of a cartilage defect within the 3D object coordinate system,

defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint,  $T_2$ ,

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

86. (Withdrawn) The method of claim 79, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

- (a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,
- (b) obtaining the bone image data of the joint with a set of skin reference markers positioned in the same manner as the markers in (a),
- (c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and
- (d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

87. (Withdrawn) The method of claim 79, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

88. (Withdrawn) The method of claim 79, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

89. (Withdrawn) The method of claim 79, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

90. (Withdrawn) The method of claim 79, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

91. (Withdrawn) The method of claim 79, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

92. (Withdrawn) The method of claim 91, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

93. (Withdrawn) The method of claim 92, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

94. (Currently Amended) A method of treating a human joint disease involving cartilage comprising:

obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;

electronically evaluating said image to obtain information about three dimensional geometry of the joint; and

selecting a therapy based on said information.

95. (Previously Presented) The method of claim 94, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,

obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,

obtaining a three-dimensional map of the cartilage at a later time,

calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

96. (Previously Presented) The method of claim 94, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

97. (Previously Presented) The method of claim 94, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,  
determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,  
obtaining the thickness of the cartilage defect,  $D_D$ , of the region,  
subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and  
multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

98. (Previously Presented) The method of claim 94, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

99. (Previously Presented) The method of claim 94, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

100. (Previously Presented) The method of claim 94, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time, T<sub>1</sub>,  
identifying a region of a cartilage defect within the 3D object coordinate system,  
defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint, T<sub>2</sub>,  
placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and  
measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

101. (Previously Presented) The method of claim 94, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,  
(a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

- (b) obtaining the bone image data of the joint with a set of skin reference markers positioned in the same manner as the markers in (a),
- (c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and
- (d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

102. (Previously Presented) The method of claim 94, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said diseased tissue or the location and size of said diseased tissue.

103. (Previously Presented) The method of claim 94, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

104. (Previously Presented) The method of claim 94, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

105. (Previously Presented) The method of claim 94, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

106. (Previously Presented) The method of claim 94, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

107. (Previously Presented) The method of claim 106, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

108. (Previously Presented) The method of claim 107, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

109. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:  
obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;  
electronically evaluating said image to obtain information about water content; and  
selecting a therapy based on said information.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

110. (Withdrawn) The method of claim 109, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,  
obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,  
obtaining a three-dimensional map of the cartilage at a later time,  
calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and  
determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

111. (Withdrawn) The method of claim 109, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

112. (Withdrawn) The method of claim 109, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,

determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,

obtaining the thickness of the cartilage defect,  $D_D$ , of the region,

subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and

multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

113. (Withdrawn) The method of claim 109, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

114. (Withdrawn) The method of claim 109, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

115. (Withdrawn) The method of claim 109, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time, T<sub>1</sub>,

identifying a region of a cartilage defect within the 3D object coordinate system,

defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint, T<sub>2</sub>,

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>i</sub>, and measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

116. (Withdrawn) The method of claim 109, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

- (a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,
- (b) obtaining the bone image data of the joint with a set of skin reference markers positioned in the same manner as the markers in (a),
- (c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and
- (d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

117. (Withdrawn) The method of claim 109, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

118. (Withdrawn) The method of claim 109, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

119. (Withdrawn) The method of claim 109, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

120. (Withdrawn) The method of claim 109, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

121. (Withdrawn) The method of claim 109, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

122. (Withdrawn) The method of claim 121, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

123. (Withdrawn) The method of claim 122, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

124. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:

obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;

electronically evaluating said image to obtain information about sodium content; and selecting a therapy based on said information.

125. (Withdrawn) The method of claim 124, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,

obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,

obtaining a three-dimensional map of the cartilage at a later time,

calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and

determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

126. (Withdrawn) The method of claim 124, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of  
the joint from a transferring device to a receiving device located distant from the transferring  
device,

receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

127. (Withdrawn) The method of claim 124, wherein said electronically evaluating  
further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a  
joint of a mammal which method comprises,  
determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,  
obtaining the thickness of the cartilage defect,  $D_D$ , of the region,  
subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and  
multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the  
volume of cartilage loss.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

128. (Withdrawn) The method of claim 124, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

129. (Withdrawn) The method of claim 124, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

130. (Withdrawn) The method of claim 124, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time,  $T_1$ ,

identifying a region of a cartilage defect within the 3D object coordinate system,

defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint,  $T_2$ ,

placing the identically-sized volume of interest into the 3D object coordinate system at timepoint  $T_2$  using the object coordinates of the volume of interest at timepoint  $T_1$ , and  
measuring any differences in cartilage volume within the volume of interest between timepoints  $T_1$  and  $T_2$ .

131. (Withdrawn) The method of claim 124, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

- (a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,
- (b) obtaining the bone image data of the joint with a set of skin reference markers

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

positioned in the same manner as the markers in (a),

- (c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and
  - (d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

132. (Withdrawn) The method of claim 124, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

133. (Withdrawn) The method of claim 124, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

134. (Withdrawn) The method of claim 124, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

135. (Withdrawn) The method of claim 124, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

136. (Withdrawn) The method of claim 124, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

137. (Withdrawn) The method of claim 136, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

138. (Withdrawn) The method of claim 137, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

139. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:

obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;

electronically evaluating said image to obtain information about hyaluronic acid content; and selecting a therapy based on said information.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

140. (Withdrawn) The method of claim 139, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,

obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,

obtaining a three-dimensional map of the cartilage at a later time,

calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and

determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

141. (Withdrawn) The method of claim 139, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,

electronically transferring an electronically generated image of a cartilage of the joint from a transferring device to a receiving device located distant from the transferring device,

receiving the transferred image at the distant location,

converting the transferred image to a degeneration pattern of the cartilage, and

transmitting the degeneration pattern to a site for analysis.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

142. (Withdrawn) The method of claim 139, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,

determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,

obtaining the thickness of the cartilage defect,  $D_D$ , of the region,

subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and

multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

143. (Withdrawn) The method of claim 139, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

144. (Withdrawn) The method of claim 139, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

145. (Withdrawn) The method of claim 139, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time,  $T_1$ ,

identifying a region of a cartilage defect within the 3D object coordinate system,

defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint,  $T_2$ ,

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

146. (Withdrawn) The method of claim 139, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

- (a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,
- (b) obtaining the bone image data of the joint with a set of skin reference markers positioned in the same manner as the markers in (a),
- (c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and
- (d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

147. (Withdrawn) The method of claim 139, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

148. (Withdrawn) The method of claim 139, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

149. (Withdrawn) The method of claim 139, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

150. (Withdrawn) The method of claim 139, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

151. (Withdrawn) The method of claim 139, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

152. (Withdrawn) The method of claim 139, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

153. (Withdrawn) The method of claim 152, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

154. (Withdrawn) A method of treating a human joint disease involving cartilage comprising:

obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;

electronically evaluating said image to obtain information about signal intensity or relaxation time of said normal or diseased tissue; and

selecting a therapy based on said information.

155. (Withdrawn) The method of claim 154, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,

obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,

obtaining a three-dimensional map of the cartilage at a later time, calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

156. (Withdrawn) The method of claim 154, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of  
the joint from a transferring device to a receiving device located distant from the transferring  
device,

receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

157. (Withdrawn) The method of claim 154, wherein said electronically evaluating  
further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a  
joint of a mammal which method comprises,  
determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,  
obtaining the thickness of the cartilage defect,  $D_D$ , of the region,  
subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and  
multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the  
volume of cartilage loss.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

158. (Withdrawn) The method of claim 154, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,

estimating the thickness or width or area or volume of a region of cartilage at an initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

159. (Withdrawn) The method of claim 154, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

160. (Withdrawn) The method of claim 154, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time, T<sub>1</sub>,  
identifying a region of a cartilage defect within the 3D object coordinate system,  
defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint, T<sub>2</sub>,  
placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and  
measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

161. (Withdrawn) The method of claim 154, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,  
(a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

- (b) obtaining the bone image data of the joint with a set of skin reference markers positioned in the same manner as the markers in (a),
- (c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and
- (d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

162. (Withdrawn) The method of claim 154, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said disease tissue or the location and size of said diseased tissue.

163. (Withdrawn) The method of claim 154, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

164. (Withdrawn) The method of claim 154, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent that protects said diseased tissue and that protects adjacent normal tissue.

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

165. (Withdrawn) The method of claim 154, wherein said information is used to determine the thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

166. (Withdrawn) The method of claim 154, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

167. (Withdrawn) The method of claim 166, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

168. (Withdrawn) The method of claim 167, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold

169. (New) A method of treating a human joint disease involving cartilage comprising:  
obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;  
electronically evaluating said image to obtain geometrical information about the joint;

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

and

determining a shape for articular repair based on said geometrical information.

170. (New) The method of claim 169, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,

obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,

obtaining a three-dimensional map of the cartilage at a later time,  
calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and

determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

171. (New) The method of claim 169, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

172. (New) The method of claim 169, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,  
determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,  
obtaining the thickness of the cartilage defect,  $D_D$ , of the region,  
subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and  
multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

173. (New) The method of claim 169, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,  
estimating the thickness or width or area or volume of a region of cartilage at an

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

174. (New) The method of claim 169, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

175. (New) The method of claim 169, wherein said electronically evaluating further comprises:

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time,  $T_1$ ,  
identifying a region of a cartilage defect within the 3D object coordinate system,  
defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,  
defining the 3D object coordinate system of the joint at a second timepoint,  $T_2$ ,  
placing the identically-sized volume of interest into the 3D object coordinate system at timepoint  $T_2$  using the object coordinates of the volume of interest at timepoint  $T_1$ , and  
measuring any differences in cartilage volume within the volume of interest between timepoints  $T_1$  and  $T_2$ .

176. (New) The method of claim 169, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

(a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,

(b) obtaining the bone image data of the joint with a set of skin reference markers

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

positioned in the same manner as the markers in (a),

(c) obtaining the optoelectrical image data of the joint with a set of skin reference markers

positioned in the same manner as (a) and (b), and

(d) using the skin reference markers to correlate the images obtained in (a), (b) and (c)

with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

177. (New) The method of claim 169, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said diseased tissue or the location and size of said diseased tissue.

178. (New) The method of claim 169, wherein said articular repair comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

179. (New) The method of claim 169, wherein said articular repair uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent.

180. (New) The method of claim 169, wherein said information is used to determine the

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

181. (New) The method of claim 169, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

182. (New) The method of claim 181, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

183. (New) The method of claim 182, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

184. (New) A method of treating a human joint disease involving cartilage comprising:  
obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;  
electronically evaluating said image to obtain geometrical information about the joint;

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

and

designing a therapy based on said geometrical information.

185. (New) The method of claim 184, wherein said electronically evaluating further comprises:

estimating the loss of cartilage in a joint, wherein the joint comprises cartilage and accompanying bones on either side of the joint, which method comprises,  
obtaining a three-dimensional map of the cartilage at an initial time and calculating the thickness or regional volume of a region of degenerated cartilage mapped at the initial time,

obtaining a three-dimensional map of the cartilage at a later time,  
calculating the thickness or regional volume of a region of degenerated cartilage mapped at the later time, and

determining the loss in thickness or regional volume of the region of degenerated cartilage between the later and initial times.

186. (New) The method of claim 184, wherein said electronically evaluating further comprises:

assessing the condition of cartilage in a joint of a human, which method comprises,  
electronically transferring an electronically generated image of a cartilage of the

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

joint from a transferring device to a receiving device located distant from the transferring device,  
receiving the transferred image at the distant location,  
converting the transferred image to a degeneration pattern of the cartilage, and  
transmitting the degeneration pattern to a site for analysis.

187. (New) The method of claim 184, wherein said electronically evaluating further comprises:

determining the volume of cartilage loss in a region of a cartilage defect of a cartilage in a joint of a mammal which method comprises,  
determining the thickness,  $D_N$ , of the normal cartilage near the cartilage defect,  
obtaining the thickness of the cartilage defect,  $D_D$ , of the region,  
subtracting  $D_D$  from  $D_N$  to give the thickness of the cartilage loss,  $D_L$ , and  
multiplying the  $D_L$  value times the area of the cartilage defect,  $A_D$ , to give the volume of cartilage loss.

188. (New) The method of claim 184, wherein said electronically evaluating further comprises:

estimating the change of cartilage in a joint of a mammal over time, which method comprises,  
estimating the thickness or width or area or volume of a region of cartilage at an

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

initial time  $T_1$ ,

estimating the thickness or width or area or volume of the region of cartilage at a later time  $T_2$ , and

determining the change in the thickness or width or area or volume of the region of cartilage between the initial and the later times.

189. (New) The method of claim 184, wherein said electronically evaluating further comprises:

providing a biochemically based map of joint cartilage of a mammal, wherein the joint comprises cartilage and associated bones on either side of the joint, which method comprises,

measuring a detectable biochemical component throughout the cartilage,

determining the relative amounts of the biochemical component throughout the cartilage,

mapping the amounts of the biochemical component in three dimensions through the cartilage, and

determining the areas of abnormally joint cartilage by identifying the areas having altered amounts of the biochemical component present.

190. (New) The method of claim 184, wherein said electronically evaluating further comprises:

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

estimating the change of cartilage in a joint, wherein the joint comprises articular cartilage, which method comprises,

defining a 3D object coordinate system of the joint at an initial time, T<sub>1</sub>,

identifying a region of a cartilage defect within the 3D object coordinate system,

defining a volume of interest around the region of the cartilage defect whereby the volume of interest is larger than the region of cartilage defect, but does not encompass the entire articular cartilage,

defining the 3D object coordinate system of the joint at a second timepoint, T<sub>2</sub>,

placing the identically-sized volume of interest into the 3D object coordinate system at timepoint T<sub>2</sub> using the object coordinates of the volume of interest at timepoint T<sub>1</sub>, and measuring any differences in cartilage volume within the volume of interest between timepoints T<sub>1</sub> and T<sub>2</sub>.

191. (New) The method of claim 184, wherein said electronically evaluating further comprises:

correlating cartilage image data, bone image data, and optoelectrical image data for the assessment of the condition of a joint, which method comprises,

(a) obtaining the cartilage image data of the joint with a set of skin reference markers placed externally near the joint,

(b) obtaining the bone image data of the joint with a set of skin reference markers

Application No.: 09/662,224

Amendment dated: April 11, 2005

Reply to Office Action dated: December 10, 2004

positioned in the same manner as the markers in (a),

(c) obtaining the optoelectrical image data of the joint with a set of skin reference markers positioned in the same manner as (a) and (b), and

(d) using the skin reference markers to correlate the images obtained in (a), (b) and (c) with each other, wherein each skin reference marker is detectable in the cartilage and bone data and the opto-electrical data.

192. (New) The method of claim 184, wherein said electronic image provides information on the thickness, shape, or curvature of said normal and said diseased tissue or the location and size of said diseased tissue.

193. (New) The method of claim 184, wherein said therapy comprises autologous chondrocyte transplantation, osteochondral allografting, osteochondral autografting, tibial corticotomy, femoral or tibial osteotomy.

194. (New) The method of claim 184, wherein said therapy uses cartilage or bone tissue grown ex vivo, stem cells, an artificial non-human material, an agent that stimulates repair of said diseased tissue, or an agent.

195. (New) The method of claim 184, wherein said information is used to determine the

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

thickness or other geometrical feature of a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold, or a tissue regenerating material or tissue repair system.

196. (New) The method of claim 184, wherein said image is obtained using ultrasound, computed tomography, positron emission tomography, a single photon emission computed tomography scan, or MRI.

197. (New) The method of claim 196, wherein said information is used to generate a three-dimensional map of cartilage thickness or a physical model of said normal or said diseased tissue or both.

198. (New) The method of claim 197, wherein said physical model is used to shape a tissue transplant, a tissue graft, a tissue implant, a tissue replacement material, a tissue scaffold or a tissue regenerating material or tissue repair system.

199. (New) A method of treating a human joint disease involving cartilage comprising:  
obtaining an electronic image of a joint, wherein said image includes both normal and diseased cartilage tissue;  
electronically evaluating said image to obtain information about volume, area, thickness,

Application No.: 09/662,224  
Amendment dated: April 11, 2005  
Reply to Office Action dated: December 10, 2004

curvature, water content, sodium content, hyaluronic acid content, signal intensity or relaxation time of said normal or diseased tissue, or three dimensional geometry of the joint; and selecting a therapy based on said information.